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Review

Route optimization in mechanized sugarcane harvesting

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ABSTRACT

Sugarcane cultivation is important for the economy of many countries, particularly for Brazil. This plant has been used to produce sugar, ethanol, second generation ethanol, fertilizers, as well as bioelectricity. Due to production growth and the establishment of mechanized sugarcane harvesting, this process needs to be optimized. High costs are linked to mechanized harvesting, which affect the total cost of production. One of the costs of harvesting is related to the long time the sugarcane harvesting machine takes to change the crop row to be cut. To help reduce costs, this work proposes a mathematical model to the Route Planning Problem for Mechanized Harvesting. This mathematical model minimizes the time of maneuvering the harvesting machine and, consequently, reduces fuel and labor costs, among others. Computer tests were performed using data supplied by a company from the sugarcane energy sector located in the state of São Paulo, Brazil. The results were compared to the traditional routes used by the company and proved the efficiency of the mathematical model in supplying solutions that minimize the time of harvesting machine maneuvers. Not only are there economic benefits, but also environmental ones that can be obtained.

Contents

1. Introduction

Sugarcane has a major importance in the Brazilian economy. The country is the biggest producer of sugarcane in the world, followed by India and China, and is the largest producer of sugar and ethanol. Brazil is responsible for approximately 20% of sugar production and 40% of the sugar exported in the world. Sugarcane is also hugely important in terms of the environment as ethanol is one of the best alternatives for reducing gas pollutant emissions, which are the fundamental cause of the greenhouse effect. According to data from the Companhia Nacional de Abastecimento (CONAB, 2015), changing gasoline to ethanol could reduce up to 70% of gas pollutant emissions.

Until 2014, sugarcane harvesting in Brazil was predominantly manual. In this harvesting strategy, the sugarcane had to be burned so it could be cut by workers, and then transported to the plant. Although ethanol is beneficial to the environment, this strategy had many negative impacts on the environment and human health because of sugarcane burning. However, due to an Agro Environmental Protocol proposed by the Sugarcane Industry Association

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